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Standard Specification for Type I Polymer Modified Asphalt Cement for Use in Pavement Construction[1]

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1. Scope

1.1 This specification covers asphalt cements that have been modified by the addition of an appropriate polymer for use in pavement construction. It was developed to provide a reference for specifying polymer-modified asphalt and reflects the properties of currently available commercial products. This is not intended to be a performance-based specification.

1.2 Type I polymer-modified asphalts are typically made with styrene-butadiene or styrene-butadiene-styrene block copolymers. However, any polymer may be used that will give the required test results when blended with the desired asphalt.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 5 Test Method for Penetration of Bituminous Materials[2]

D 36 Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)[3]

D 92 Test Method for Flash and Fire Points by Cleveland Open Cup[4]

D 113 Test Method for Ductility of Bituminous Materials[2]

D 140 Practice for Sampling Bituminous Materials[2]

D 1754 Test Method for Effect of Heat and Air on Asphaltic Materials (Thin-Film Oven Test)[2]

D 2042 Test Method for Solubility of Asphalt Materials in Trichloroethylene[2]

D 2170 Test Method for Kinematic Viscosity of Asphalts (Bitumens)[2]

D 2872 Test Method for Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin-Film Oven Test)[2]

D 4957 Test Method for Apparent Viscosity of Asphalt Emulsion Residues[2] and Non-Newtonian Bitumens by Vacuum Capillary Viscometer[2]

D 6084 Test Method for Elastic Recovery of Bituminous Materials by Ductilometer[2]

E 11 Specification for Wire-Cloth and Sieves for Testing Purposes[5]

3. Manufacture

3.1 The asphalt used to prepare the polymer-modified asphalt cement shall be prepared by the refining of crude petroleum by suitable means.

4. Physical Requirements

4.1 The polymer-modified asphalt cement shall be homogeneous and free from water and shall not foam when heated to 175°C (347°F).

4.2 The polymer-modified asphalt cement shall conform to the requirements of Table 1.

4.3 The polymer modifier and asphalt cement shall be compatible and pre-blended prior to use.

5. Methods of Sampling and Testing

5.1 Sample and test the polymer-modified asphalt cement in accordance with the following test methods or practice:

5.1.1 *Sampling*—Practice D 140.

5.1.2 *Penetration*—Test Method D 5.

5.1.3 *Viscosity at 60°C (140°F)*—Test Method D 4957.

5.1.4 *Viscosity at 135°C (275°F)*—Test Method D 2170.

5.1.5 *Ring and Ball Softening Point*—Test Method D 36.

5.1.6 *Flash Point, Cleveland Open Cup*—Test Method D 92.

5.1.7 *Rolling Thin Film Oven Test*—Test Method D 2872.

5.1.8 *Thin Film Oven Test*—Test Method D 1754.

5.1.9 *Solubility*—Test Method D 2042.

5.2 *Elastic Recovery*—Test Method D 6084.

6. Test Methods for Type I Polymer-Modified Asphalt Binder

6.1 *Summary of Separation Test*:

6.1.1 *Scope*—The separation of polymer and asphalt during

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[2] *Annual Book of ASTM Standards*, Vol 04.03.

[3] *Annual Book of ASTM Standards*, Vol 04.04.

[4] *Annual Book of ASTM Standards*, Vol 05.01.

[5] *Annual Book of ASTM Standards*, Vol 14.02.

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TABLE 1 Physical Property Requirements for Type I Polymer-Modified Asphalts

Designation	I-A		I-B		I-C		I-D	
	min	max	min	max	min	max	min	max
Penetration, 25°C (77°F), 100 g, 5 s, dmm	100	150	75	100	50	75	40	75
Viscosity, 60°C (140°F), 1 s^{-1}, poise[A]	1250		2500		5000		5000	
Viscosity, 135°C (275°F), cSt		2000		2000		2000		5000
Flash Point, COC, °C (°F)	232 (450)		232 (450)		232 (450)		232 (450)	
Solubility in trichloroethylene, %	99		99		99		99	
Separation, difference, °C (°F)		2.2 (4)		2.2 (4)		2.2 (4)		2.2 (4)
Tests on RTFOT Residue[B]								
Elastic recovery, 25°C (77°F), 10 cm elongation, %	60		60		60		60	
Penetration, 4°C (39.2°F), 200 g, 60 s, dmm	20		15		13		10	

[A] The absolute viscosity should be run in a modified Koppers or Asphalt Institute vacuum capillary viscometer. Report the viscosity at a shear rate of 1 reciprocal second.
[B] The thin film oven test may be used, but the rolling thin film test shall be the referee method.

hot storage is evaluated by comparing the ring and ball softening point of the top and bottom portions taken from a conditioned, sealed tube of polymer-modified asphalt. The conditioning consists of placing a sealed tube of polymer-modified asphalt in a vertical position in a 163± 5°C (325 ± 10°F) oven for a 48-h period.

6.1.2 *Referenced Documents*—Test Method D 36 and Specification E 11.

6.1.3 *Apparatus*:

6.1.3.1 *Aluminum Tubes*[6]—25.4-mm (1-in.) diameter by 139.7-mm (5.5-in.) length blind aluminum tubes used to hold the test sample during the conditioning.

6.1.3.2 *Oven*, capable of maintaining 163 ± 5°C (325 ± 10°F).

6.1.3.3 *Freezer*, capable of maintaining − 6.7 ± 5°C (20 ± 10°F).

6.1.3.4 *Rack*, capable of supporting the aluminum tubes in a vertical position in the oven and freezer.

6.1.3.5 *Spatula and Hammer*—The spatula must be rigid and sharp to allow cutting of the tube containing the sample when at a low temperature.

6.1.4 *Procedure*:

6.1.4.1 Place the empty tube with the sealed end down in the rack.

6.1.4.2 Carefully heat the sample until sufficiently fluid to pour. Care should be taken to avoid localized overheating. Strain the melted sample through a No. 50 sieve conforming to Specification E 11. After thorough stirring, pour 50.0 g into the vertically held tube. Fold the excess tube over two times and crimp and seal.

6.1.4.3 Place the rack containing the sealed tubes in a 163 ± 5°C (325 ± 10°F) oven. Allow the tubes to stand undisturbed in the oven for a period of 48 ± 1 h. At the end of the heating period, remove the rack from the oven and immediately place in the freezer at − 6.7 ± 5°C (20 ± 10°F), taking care to keep the tubes in a vertical position at all times. Leave the tubes in the freezer for a minimum of 4 h to solidify the sample completely.

6.1.4.4 Upon removing the tube from the freezer, place the tube on a flat surface. Cut the tube into three equal length portions with the spatula and hammer. Discard the center portion and place the top and bottom portion of the tube into separate beakers. Place the beakers in a 163 ± 5°C (325 ± 10°F) oven until sufficiently fluid to remove the pieces of aluminum tube.

6.1.4.5 After a thorough stirring, pour the top and bottom samples into appropriately marked rings for the ring and ball softening point test. Prepare the rings and apparatus as described in Test Method D 36.

6.1.4.6 The top and bottom samples from the same tube should be tested at the same time in the softening point test.

6.1.5 *Report*—Report the difference in °C or °F of the softening point between the top and bottom portions.

6.1.6 *Precision and Bias*—No statement is made regarding either the precision or bias of this test method for measuring separation since the result states merely whether there is conformance to the criteria for success specified in the procedure.

7. Keywords

7.1 asphalt; polymer modified asphalt; specification

[6] Aluminum tubes suitable for this purpose may be obtained from R/H Specialty & Machine, P. O. Box 10187, Terre Haute, IN 47801, (812) 232–0781. Observations have been reported regarding leakage of asphalt from the bottom of the tube during the conditioning period. Other tubes may be required if this leakage is significant.

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